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EARNED VALUE MANAGEMENT APPLIED TO AN ENGINEERED-TO-ORDER MULTIPLE PROJECT ENVIRONMENT

by

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Master of Engineering (Research)

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CERTIFICATE OF ORIGINALITY

I certify that the work in this thesis titled "Earned Value Management Applied to an Engineered-To-Order Multiple Project Environment" has not previously been submitted for a degree nor has it been submitted as part of the requirements for a degree except as fully acknowledged within the text. I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student:

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David Lincoln Fox

Date: Monday, 31st December 2012

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NOMENCLATURE

The content of this Nomenclature has been broken into two parts, **Part A** covers the acronyms relating to general text while part **Part B** specifically deals with the terms associated with Earned Value Management.

Part A – General Text

ANSI	American National Standards Institute
AS	Australian Standards
AUD	Australian Dollar
DoD	(US) Department of Defense
DoE	(US) Department of Energy
EIA	Electronic Industries Alliance
EPCM	Engineering Procurement and Construction Management
ERP	Enterprise Resource Planning (software tool)
FI	Final Inspection
GFC	Global Financial Crisis (2008)
FAR	Federal Acquisition Regulation
Host	L&A Pressure Welding Pty Ltd
IPT	Independent Product Team
KPI	Key Performance Indicator
LAP	L&A Pressure Welding Pty Ltd
LNG	Liquefied Natural Gas
LPG	Liquid Petroleum Gas
MBWA	Management By Walking Around
NASA	(US) National Aeronautics and Space Administration
NDIA	(US) National Defence Industrial Association
N/A	Not Available
OMB	(US) Office of Management and Budget
OPM3	PMI's Organisational Project Management Maturity Model

PE	(LAP) Project Engineer
PMI	Project Management Institute
PMS	Project Management System
PPM	Project Portfolio Management
PWHT	Post Weld Heat Treatment
SME	Small to Medium Enterprise
US	United States of America
wrt	'With Respect To'
~	Approximately

Part B1 – Earned Valve Management

AC	Actual Cost
AD	Actual Duration
AT	Actual Time
BAC	Budget at Completion
CAP	Control Account Plan
CPI	Cost Performance Index
C/SCSC	Cost / Schedule Control Systems Criteria
CV	Cost Variance
EAC	Estimate at Completion
EAC_t	Estimate at Completion (time)
$EAC_{\#}$	Estimate at Completion (general term)
ED	Estimated Duration or Earned Duration, as text suggests
EDAC	Estimate of Duration at Completion
ES	Earned Schedule measure
ETC	Estimate to Completion
ETC_t	Estimate to Completion (time)
EV	Earned Value

EVM	Earned Value Management
$IEAC_t$	Independent Estimate at Completion (time)
$IEAC_{\#}$	Independent Estimate at Completion (general term)
IECD	Independent Estimate of the Completion Date
IED	Independent Estimate of (project) Duration
IEDAC	Independent Estimated of Duration at Completion
LB	Labour Budget
LO	Labour Only
LOE	Level of Effort
MR	Management Reserve
PB	Project Budget
PBB	Project Budget Base
PD	Planned Duration
PDWR	Planned Duration for Work Remaining
PERT	Project Evaluation and Review Technique
PF	Performance Factor
PMB	Performance Measurement Baseline
PT	Planned Time
PV	Planned Value
SAC	Schedule at Completion
SPI	Schedule Performance Index
SPI_t	Schedule Performance Index (time)
$SPI_{\#}$	Schedule Performance Index (general term)
SV	Schedule Variance
SV_t	Schedule Variance (time based)
TCPI	To Complete Performance index
TEAC	Time Estimate at Completion
TPB	Time Phase Budget

TSD	Total Scheduled Days
TSPI	To complete Schedule Performance index
TV	Time Variance
VAC	Variance at Completion
VAC_t	Variance at Completion (time)
WBS	Work Breakdown Structure
WDC	Work Description Cell(s)
WP	Work Package

ABSTRACT

The supply of Engineered-to-Order pressure equipment in Australia has established a place in the global market. Local manufacturing requires innovation to maintain its position in this supply chain. Changes at the manufacturing level looked to project management to connect the end product's development and delivery with the end user's needs. Earned Value Management (EVM) offers project management a best practice in project control and its application to this niche market was considered worthy of investigation as a response to market changes.

EVM has a long history of application in large and complicated projects. This provided researchers with material to study application detail across the cost and time domains, resulting in well-established theories about performance outputs and forecasting. EVM implementation has also been the subject of research offering guidance to the user. An area of EVM that remains in the background is the application, implementation and benefits of the method in the smaller manufacturing sector. This research applies EVM to a project orientated organisation that designs and manufactures customised pressure equipment. The objective of this practice-based research is to address questions of EVM application, implementation and benefits when applied to a multiple project environment set within an operations context.

A series of twelve projects carried out by the host organisation were subject to EVM application. This provided data to assess the response of EVM to the short duration project and to explore various forecasting behaviours from both the cost and time domains under different reporting frequencies. The process of application was also used to establish qualitative information on implementation and organisational effects as a result of the methods presence.

Results indicated EVM is adaptable to the sampled manufacturing projects and tracking capabilities were positive on the few larger projects in the sample. Net benefit to the internal project management function is not represented by EVM tracking, when restricted to the short duration project. Forecasting of both cost and time was adversely affected by high material costs, but displayed stability after this project phase. Exclusion of materials

simplified application by reducing administration effort however it did exaggerate deviation of progress from the plan.

High project and organisational value is realised by access to EVM's data sources and structure. It was therefore concluded EVM methodology, coupled to organisational project management and business system theories can deliver substantial operational gains for the project orientated manufacturer.